Routledge
Taylor & Francis Group

Journal of Research on Technology in Education

ISSN: 1539-1523 (Print) 1945-0818 (Online) Journal homepage: https://www.tandfonline.com/loi/ujrt20

# Bringing Disability Into the Discussion: Examining Technology Accessibility as An Equity Concern in the Field of Instructional Technology

Natalie L. Shaheen & Sarah Lohnes Watulak

**To cite this article:** Natalie L. Shaheen & Sarah Lohnes Watulak (2019) Bringing Disability Into the Discussion: Examining Technology Accessibility as An Equity Concern in the Field of Instructional Technology, Journal of Research on Technology in Education, 51:2, 187-201, DOI: 10.1080/15391523.2019.1566037

**To link to this article:** https://doi.org/10.1080/15391523.2019.1566037

Published online: 13 Feb 2019.

JRTE | Vol. 51, No. 2, pp. 187–201, © 2019 ISTE | iste.org/jrte
DOI: 10.1080/15391523.2019.1566037



# Bringing Disability Into the Discussion: Examining Technology Accessibility as An Equity Concern in the Field of Instructional Technology

**Natalie L. Shaheen**
*Towson University;*

**Sarah Lohnes Watulak**
*Middlebury College*

## Abstract

*This article presents a review of the literature, pertaining to technology accessibility in K–12 schools in the United States, in order to bring technology accessibility into conversations about equity in instructional technology with the goal of ensuring that disabled learners have equal access to the technology-enhanced learning opportunities that are an increasingly integral part of K–12 education. The findings of the review indicate that despite long-standing federal and state accessibility mandates, inaccessible technologies abound in K–12, denying disabled learners equal access to education. We conclude that technology accessibility is an equity concern that must be prioritized in instructional technology discourse, research, and practice to begin addressing the inequality that disabled learners face in technology-enhanced K–12 learning environments. (Keywords: instructional technology, equity, disability, accessibility, K–12, education)*

In the field of instructional technology, discussions of equity can be traced back to early conversations about the digital divide, which first centered on closing the gap between those who did and did not own computer hardware and software. More recent discussions around the digital divide have shifted from a hardware/software gap, to closing a gap in Internet access, and in particular, access to high-speed broadband Internet (Warschauer, 2002). Current conversations about equity in instructional technology address topics such as equitable access to maker activities, computer science instruction, and game-based learning (Gee & Hayes, 2010; Mehta et. al, 2018; Vossoughi, Hooper, & Escudé, 2016), and have examined the underrepresentation of women, people of color, and people from under-resourced communities (Vossoughi et. al., 2016).

Disabled people, however, remain absent from conversations about equity in the research and discourse of the field (see the Language usage section for an explanation of the disability language conventions used herein). Just as other minority groups have faced marginalization due to the increased use of technology in American life and in U.S. schools, so have disabled people (Krach & Jelenic, 2009). While it is common knowledge that some physical environments are inaccessible to disabled people, many people are unaware that countless digital environments are also inaccessible (Wisdom et al., 2007). Inaccessible technologies are as problematic for disabled people as inaccessible buildings. As technology becomes more prevalent in K–12 education, disabled people confront accessibility barriers and thereby discrimination more frequently.

While discussions of accessibility are largely absent from research and discourse in instructional technology, K–12 institutions in the United States are becoming increasingly aware of the barriers that inaccessible technologies present to their learners. Specifically, since 2014, more than 2,400 K–12 local and state education agencies have received letters from the Office for Civil Rights (OCR, 2011) in the U.S. Department of Education informing them that their websites are inaccessible (Keierleber, 2018). Complaints filed by one disability rights advocate in Michigan precipitated the OCR letters. Additionally, advocates in other locales have filed lawsuits and initiated media campaigns against K–12 schools for their inaccessible technology (Shaheen & Lazar, 2018; Lazar, Goldstein, & Taylor, 2015). The OCR complaints, lawsuits, and media coverage have caught many K–12 institutions—which often lack knowledge about technology accessibility (Noble, 2005; Wisdom et al., 2007)—off guard. Prompted by the recent work of advocates, some state and district-level administrators have begun to discuss technology accessibility to raise awareness and preempt compliance concerns.

Although these initiatives have only recently brought technology accessibility to the attention of many K–12 schools, technology accessibility is not a new idea. Technology accessibility has been encoded in U.S. law for two decades (i.e., Section 508 of the Rehabilitation Act of 1973), has been discussed in the computer science literature since at least the 1980s, and has been addressed in the U.S. Department of Education's National Education Technology Plan since 1996 (Shaheen & Lazar, 2018; Vanderheiden, 1988, 1990). If technology accessibility has been a legal requirement for two decades, why are so many K–12 local and state education agencies unaware of the requirement?

This article presents a review of the literature pertaining to technology accessibility in U.S. K–12 schools, in order to bring technology accessibility into conversations about equity in instructional technology with the goal of ensuring that disabled learners have equal access to technology-enhanced learning opportunities. The findings of the review indicate that despite long-standing federal and state accessibility mandates, inaccessible technologies abound in K–12 schools, denying disabled learners equal access to education. We conclude with recommendations for how K–12 stakeholders can move forward to ensure that disabled people have equal access to instructional technology.

## Language Usage

Cultural and professional norms impact language usage. This is particularly true of the language of disability. The use of "person-first language" (i.e., "a person with a disability" instead of "a disabled person") is common in the United States and is required by the American Psychological Association (APA) style guide; accordingly, educators are encouraged to use person-first language in discussions of disability (VandenBos, 2010). However, person-first language is not fully supported by the disability community (Brueggemann, 2013; Davis, 2013; Dunn & Andrews, 2015); it is strongly opposed by some who argue that such terminology "implies that disability is somehow a diminished aspect of the self, rather than an aspect of identity that is a source of pride" (Foley & Ferri, 2012, p. 192). In 1993, the National Federation of the Blind (NFB, 1993), a United States-based advocacy organization, passed a resolution rejecting the use of person-first terminology; similar positions have been expressed by Deaf as well as autistic people (Brown, 2011; Dunn & Andrews, 2015).

We, as a disabled person and an ally, reject person-first language. Throughout this article, we utilize "identity-first" language, where disability-related adjectives are used in the same way that other adjectives are used to describe humans (i.e., "disabled person," a construction analogous to "beautiful person"). This practice serves to recognize the historical

marginalization of disabled people and to examine the power of the able-bodied majority to prescribe the language of disability (Dunn & Andrews, 2015).

## Technology Accessibility

Technology accessibility addresses how the needs of disabled people should be incorporated into the development and implementation of mainstream technologies to ensure disabled people have equitable access to technology in various settings, including K–12 education (Hashey & Stahl, 2014). Accessible technology can be defined as technology that provides able-bodied people and disabled people access to the same content and functionality, at the same time and in the same place with substantially equivalent ease of use (U.S. Department of Education & U.S. Department of Justice, 2010). In the United States, the Section 508 regulations of the Rehabilitation Act of 1973 operationalize the definition of technology accessibility by providing a technical standard, the Web Content Accessibility Guidelines (WCAG) 2.0 level AA, which can be used to measure the accessibility of a technology (U.S. Access Board, 2017). While the WCAG standard pertains primarily to Web-based technologies, the four underlying principles—perceivable, operable, understandable, and robust—can be used to examine the accessibility of other technologies. The World Wide Web Consortium (2013) offered specific guidance about how to apply the WCAG standard to non-Web-based technologies.

When thinking about disabled learners using technology, educators and instructional technologists often think of assistive technology (AT) as a viable solution. However, disabled learners often need both AT and accessible technology in order to have full and equal access. Disabled people use AT and accessible technology simultaneously to access digital content and spaces, analogous to the way that disabled people use AT and accessible buildings to access physical spaces. For example, a physically disabled student might access her accessible school building by navigating in her wheelchair (AT) up the ramp and through the automatic door. If a disabled student has AT, but the physical or digital space the student needs to access is inaccessible, the student cannot enter the space and therefore is excluded from the learning that happens therein.

AT and accessible technology are related but distinct constructs. One key difference between AT and accessible technology is that AT is designed specifically for a group of disabled people who have a particular set of needs. For example, screen access software is an AT designed to provide blind and other print-disabled people alternative access (e.g., audio or Braille) to content displayed on a screen, and switch technology is designed to provide physically disabled people an alternative to mouse and keyboard input. Conversely, accessible technology (e.g., an accessible website) is mainstream technology that is interoperable with AT and, therefore, designed to simultaneously meet the needs of disabled and able-bodied people. Over the last several years, the line between AT and accessible mainstream technology has begun to blur as companies like Apple have developed integrated AT for their operating systems (i.e., VoiceOver, Zoom, built-in dictation).

# Methods

To better understand the ways in which technology accessibility is included in the research and discourse of instructional technology, and particularly, in conversations around equity, we conducted a literature review pertaining to technology accessibility in K–12 schools. The question that guided the literature review was: How can an understanding of the discourse and practice pertaining to K–12 technology accessibility shape future work in the field of instructional technology to ensure equitable access for all learners? This section describes the scope of the literature review and the data collection methods used to identify sources.

## Scope

The scope of this review was limited to literature that (a) specifically addressed technology accessibility, as opposed to AT or the conversion of analog materials (e.g., print books) into alternative formats (e.g., Braille, audio), and (b) specifically addressed the K–12 formal education setting in the United States. In alignment with the scope of the review, three inclusion criteria were employed to identify relevant sources. First, the literature had to be published either as (a) a peer-reviewed journal article or conference proceeding, (b) policy guidance issued by the federal government, or (c) relevant litigation. Second, the literature had to be published between 2003 and 2018, a time frame that captures both the current and historical discourse and research. Third, the literature had to address technology accessibility in U.S. K–12 formal education.

## Data Collection

Potential articles were located in three phases of data collection. In the first phase, the authors ran a query in databases such as Academic Search Complete, ERIC, Education Research Complete, JSTOR, and EBSCOhost—using the Boolean search string "accessib* AND disab* AND Technol*" and limiters for the year of publication (i.e., 2003–2018), the geographic region (i.e., the United States), and the language of publication (i.e., English). The title and abstract of each of the 116 articles, which were returned in the initial query, were read to determine whether the articles fit the inclusion criteria. The words "accessible," "disability," and "technology" are frequently used in articles pertaining to AT; consequently, a number of the search results addressed AT. These articles received additional screening (i.e., the article was skimmed) to determine whether or not technology accessibility was also addressed. For example, the Kamei-Hannan (2008) article addressed the use of AT in a standardized testing environment, but also addressed the accessibility of the computer adapted test and, as a result, was included in the sample. Of the original 116 articles, 8 met the inclusion criteria.

In the second phase of data collection, the authors ran a query in Google Scholar using the same Boolean search string and the same limiters. The Google Scholar query returned 398 results, which included the 116 results that were originally located in the first round of data collection. We read the title and abstract of each of the 282 new articles and identified 3 additional articles that met the inclusion criteria.

In the third phase of data collection, we used snowball sampling to identify additional articles. The snowball sampling consisted of examining the titles and abstracts for all of the sources that appeared in the reference lists of each of the 11 previously identified articles. From the group of 249 articles that appeared in reference lists, 6 met the inclusion criteria. In the three rounds of data collection, in total 647 articles were examined, resulting in a corpus of 17 articles.

An examination of descriptive statistics for the corpus ($n = 17$) reveals that most of the literature was published more than a decade ago. Furthermore, the corpus is light on empirical research, and primarily consists of automated accessibility evaluations of K–12 institutions' websites. Only 18% ($n = 3$) of the articles in the sample were published in the last 5 years (2014–2018), whereas 59% ($n = 10$) were published in the first 5 years (2003–2007) of the time frame that was examined. Only 53% ($n = 9$) of the articles in the sample report empirical research. Of the nine empirical research articles, only 22% ($n = 2$) were published in the last 10 years (2009–2018). Furthermore, 67% ($n = 6$) of the empirical research articles focus on one small piece of technology accessibility, the accessibility of K–12 institutions' websites. See Table 1 for an overview of the corpus. The results from a thematic analysis of the corpus are reported in the following section.

*Table 1.* Overview of the Sample.

| Author(s) | Year | Publication source | Empirical | Website |
|---|---|---|---|---|
| Bray, Flowers, & Gibson | 2003 | *Information Technology in Childhood Education Annual* | x | x |
| Bray, Flowers, Smith, & Algozzine | 2003 | *Education* | x | x |
| Hendricks, Wahl, Stull, & Duffield | 2003 | *Information Technology and Disabilities* | | |
| Opitz, Savenye, & Rowland | 2003 | *Journal of Special Education Technology* | x | x |
| Noble | 2005 | *Information Technology and Disabilities* | | |
| Peterson | 2005 | *Information Technology and Disabilities* | | |
| Kaplan, Weiss, & Allen | 2006 | *Proceedings of Society for Information Technology & Teacher Education International Conference* | | |
| Wells & Barron | 2006 | *Journal of Special Education Technology* | x | x |
| Bray, Flowers, & Algozzine | 2007 | *Clearing House* | x | x |
| Wisdom et al. | 2007 | *Educational Technology & Society* | x | |
| Kamei-Hannan | 2008 | *Journal of Visual Impairment & Blindness* | x | |
| Krach & Jelenic | 2009 | *Journal of Special Education Technology* | x | x |
| U.S. Dept. of Justice & U.S. Dept. of Education | 2010 | *Dear Colleague Letter* | | |
| U.S. Dept. of Education | 2011 | *Frequently Asked Questions Document* | | |
| Hashey & Stahl | 2014 | *Teaching Exceptional Children* | | |
| *Nightingale v. Seattle School District* | 2014 | n/a | | |
| Author | 2018 | | x | |

## Results

An analysis of the 17 articles identified for this literature review found four overarching themes. First, technology accessibility is positioned as a mandate in the literature, with a great deal of discussion dedicated to explaining which U.S. laws comprise the mandate. Second, the effort of a number of actors—including state and federal government officials as well as disability rights advocates—to promote technology accessibility and encourage K–12 stakeholders to act is also well documented. Third, some discussion of the barriers to the adoption of technology accessibility in K–12 is present in the literature. Finally, the literature reveals that inaccessible technology is common in K–12 education.

### Technology Accessibility As a Mandate

Inaccessible technology excludes disabled people from participating in and engaging with digital services, activities, and programs and thus discriminates against disabled people solely on the basis of their disability (Shaheen & Lazar, 2018; U.S. Department of Justice & U.S. Department of Education, 2010). Disability discrimination, like other forms of discrimination, is prohibited under U.S. law. It follows then that a prominent theme across the available literature is discussion of technology accessibility as a mandate in the United States, which arises from both federal and state laws that protect the rights of disabled people.

**Federal mandate**. Two federal laws, the Americans with Disabilities Act (ADA) and the Rehabilitation Act of 1973, are discussed heavily and a third federal law, the Individuals with Disabilities Education Act (IDEA), is addressed briefly in the corpus (Shaheen & Lazar, 2018; Bray, Pugalee, Flowers, & Algozzine, 2007; Hashey & Stahl, 2014; Krach & Jelenic, 2009; U.S. Department of Education, 2011; U.S. Department of Justice & U.S. Department of Education, 2010). These laws, according to the literature, comprise the federal technology accessibility mandate.

The rights of disabled people are protected under the ADA and the Rehabilitation Act of 1973. Under the ADA, disabled people are afforded equal access to state and local government (Title II) programs, services, and activities, as well as places of public accommodation (Title III) (U.S. Department of Justice & U.S. Department of Education, 2010). Furthermore, the federal government—and entities that receive federal funding—is

prohibited under Section 504 of the Rehabilitation Act of 1973 from (a) discriminating against disabled people on the basis of their disability and (b) denying disabled people from participating in or benefiting from their programs (U.S. Department of Justice & U.S. Department of Education, 2010). If government (or government-funded) programs, services, and activities or places of public accommodation utilize technology, that technology needs to be accessible to facilitate equal access and prevent discrimination.

Both of these federal laws apply to K–12 education entities based on the definitions provided in the statutes. Title II of the ADA applies to public K–12 schools because they are considered a subdivision of local government, and Title III applies to private schools because they are considered places of public accommodation. K–12 schools must adhere to the requirements of Section 504 of the Rehabilitation Act of 1973 because they receive federal funding (Hashey & Stahl, 2014; U.S. Department of Justice & U.S. Department of Education, 2010).

In addition to Section 504 of the Rehabilitation Act of 1973, Section 508 is also briefly discussed in the literature. Section 508 requires that information technology that is developed, procured, or maintained by the federal government be accessible to disabled people (Shaheen & Lazar, 2018). The Section 508 regulations, which were updated in 2017, set forth a technical standard by which the accessibility of a technology can be measured. Though Section 508 is not directly applicable to K–12 schools, Shaheen & Lazar (2018) argued that K–12 schools would benefit from using the Section 508 technical standard as a benchmark for measuring the accessibility of technology.

IDEA is the federal law that receives the least attention in the corpus, and scholars seem to disagree about the relationship between IDEA and technology accessibility. Krach and Jelenic (2009) posited that IDEA is central to the mandate for technology accessibility in K–12, citing Section 650(1)(12) of IDEA 2004. Shaheen & Lazar (2018), however, asserted that even though IDEA discusses technology and people with disabilities, "it does not say the technology has to be accessible and the law does not provide any mechanism for enforcing technology accessibility in K–12" (p. 85). The policy guidance issued by the U.S Departments of Education and Justice (2010, 2011) regarding technology accessibility mandates in education referenced both the ADA and the Rehabilitation Act of 1973 but did not mention IDEA. Finally, in a lawsuit filed against a K–12 school district for discriminating against a blind mother by employing inaccessible technology, violations were cited under the ADA and the Rehabilitation Act of 1973, but there was no mention of IDEA, as the lawsuit did not pertain to a student (*Nightingale v. Seattle School District*, 2014). IDEA's narrow focus on disabled students may be one reason that it is discussed less frequently than the ADA and the Rehabilitation Act of 1973, given that K–12 schools also have obligations to disabled parents, employees, and community members.

**State mandate**. In addition to federal mandates, state-level technology accessibility mandates also exist, though they are not as widely addressed in the literature (Shaheen & Lazar, 2018; Hendricks, Wahl, Stull, & Duffield, 2003). A study of state-level policy found that 19 states had technology accessibility statutes, many of which bore similarities to Section 508 of the Rehabilitation Act of 1973 (Shaheen & Lazar, 2018). Of the 19 state technology accessibility statutes, 47% ($n = 9$) mentioned education broadly and 10.5% ($n = 2$) mentioned K–12 specifically. The Kentucky statute, for example, articulates its applicability to K–12 schools by specifying that "State-assisted organization means a college, university, … school system, or other entity supported in whole or in part by state funds" (Ky. Rev. Stat. Ann. § 61.980 (10) et seq.). Shaheen & Lazar (2018) pointed out that although only 19 states have technology accessibility statutes, many more have other forms of policy that require accessible technology, such as Tennessee House Joint Resolution 57 (109$^{th}$ Congress).

Even when K–12 schools are not mentioned explicitly in state-level technology accessibility statutes and policies, K–12 schools are often still required to comply with the provisions of these policies. Access to education, and the technology used therein, is a civil right of all Americans—including disabled Americans. Therefore, "requiring [the] use of an emerging technology in a classroom environment when the technology is inaccessible to an entire population of individuals with disabilities—individuals with visual disabilities—is discrimination prohibited by the Americans with Disabilities Act of 1990 (ADA) and Section 504 of the Rehabilitation Act of 1973 (Section 504)" (U.S. Departments of Education & Justice, 2010, p. 1). In addition to discussing the existence of technology accessibility mandates in the United States, the literature also highlights work promoting technology accessibility and encouraging K–12 stakeholders to act.

## Promoting Technology Accessibility And Encouraging K–12 Stakeholders To Act

In order to help K–12 schools address technology accessibility mandates, actors from state government, federal government, and the disability community have initiated efforts to promote technology accessibility and encourage K–12 stakeholders to act (Bray et. al, 2007; Hashey & Stahl, 2014; Hendricks et al., 2003; Kaplan, Weiss, & Allen, 2006; Krach & Jelenic, 2009; Noble, 2005; Peterson, 2005; U.S. Department of Education and U.S. Department of Justice, 2010; U.S. Department of Education, 2011; Wisdom et al., 2007). At the state level, technology accessibility promotion and encouragement occurred in the early 2000s in Kentucky, New Mexico, Maryland, and South Carolina (Hendricks et al., 2003; Kaplan et al., 2006; Noble, 2005; Peterson, 2005). Looking at the work across the four states, five commonalities are apparent. First, the work was done by or in conjunction with the state department of education. Second, the work was connected to state-level technology accessibility legislation or policy. Third, providing technical assistance to K–12 personnel was a cornerstone of the work. Fourth, the state initiatives incorporated technology accessibility considerations into technology procurement processes at both the state level and the district level. Finally, strategic partnerships were developed with local school districts to further facilitate the adoption of technology accessibility.

The federal government has engaged in more recent initiatives to promote technology accessibility and encourage K–12 to act. In 2010, after receiving several complaints from disabled students regarding the inaccessibility of the Kindle e-reader devices being used in their schools, the U.S. Departments of Education and Justice issued a joint Dear Colleague Letter to make educational institutions aware that (a) Kindle devices were not accessible to many disabled students and (b) using inaccessible technology in the classroom discriminated against disabled students and was a violation of U.S. law. In 2011, the U.S. Department of Education followed up with a frequently asked questions document to further clarify the intent and meaning of the Dear Colleague Letter. In the frequently asked questions document, the Department of Education (2011) clarified that (a) technology accessibility mandates applied to both K–12 and higher education, (b) accessible technology is required whether or not the educational institution currently has any disabled students, and (c) the Dear Colleague Letter did not set forth any new mandates, but rather, it served to draw attention to mandates that had been in place for many years.

Outside of the government, disability rights advocates, not surprisingly, have also played a large role in the effort to promote technology accessibility and encourage K–12 to act. Their work has taken two primary forms—grassroots advocacy and legal action (Shaheen & Lazar, 2018; *Nightingale v. Seattle School District*, 2014). The grassroots advocacy has included activities such as protests and media campaigns, and the legal action has occurred as both formal litigation and administrative complaints filed with OCR. In *Nightingale v. Seattle School District* (2014), a blind mother and the NFB sued the Seattle School District

because its website was inaccessible and the district was using an inaccessible math software program. Since 2014, more than 2,400 OCR complaints have been filed against state departments of education, public school districts, charter schools, and schools for the deaf and blind, among others (Shaheen & Lazar, 2018; Keierleber, 2018). Legal action, though costly and time-consuming, scholars have argued, provides significant motivation for K–12 schools to act on technology accessibility (Krach & Jelenic, 2009; Wisdom et al., 2007).

## Barriers To The Adoption of Technology Accessibility in K–12

Despite the promotion of technology accessibility and encouragement from various actors, several barriers have hampered widespread adoption of technology accessibility in K–12. Four key barriers are discussed within the corpus: lack of knowledge about accessibility, divisions between district technology and special education departments, difficulties with incorporating accessibility into technology procurement, and funding. Lack of knowledge about technology accessibility is arguably the most problematic of the four identified barriers. A survey of all of the K–12 school districts in Kentucky found that 23.4% of respondents had never heard of Section 508 and 67.5% had never heard of the automated accessibility checker tools, such as Bobby, that were popular at the time (Noble, 2005). Furthermore, the knowledge barrier extends beyond issues with basic awareness about technology accessibility; Noble (2005) asserted that K–12 personnel who have basic familiarity with technology accessibility frequently have difficulty differentiating between AT and accessible technology. Hendricks and colleagues (2003) found that many K–12 personnel lacked sufficient knowledge of accessibility to accurately evaluate whether or not a technology met accessibility standards.

The division and lack of collaboration between technology and special education departments pose yet another barrier (Wisdom et al., 2007). Noble (2005) argued that technology accessibility is often viewed by K–12 stakeholders as a special education problem, but the special education department does not have sufficient knowledge about information technology to address accessibility issues. Similarly, technology departments lack sufficient knowledge about the needs of disabled users to feel confident addressing accessibility in the development and procurement of information and instructional technologies. Consequently, when the two departments work in isolation, technology accessibility—and thereby disabled learners—gets lost in the knowledge and communication gap between the two departments.

Technology procurement, which was promoted by state initiatives in the early 2000s as a good vehicle to increase accessibility, can also be a source of conflicting ideals. Technology procurement was particularly problematic when school districts did not incorporate accessibility concerns into the decision-making process (Wisdom et al., 2007), which sometimes happened when districts were focused on keeping up with the pace of technology development (Krach & Jelenic, 2009). Even when districts were proactive and incorporated technology accessibility into procurement processes, they sometimes found that no accessible products existed in the marketplace (Hendricks et al., 2003).

The final barrier addressed in the corpus is funding, a commonly cited hurdle for a plethora of work in K–12. Wisdom and colleagues (2007) found that some districts were addressing technology accessibility on a case-by-case basis due to a lack of funding. Interestingly, Wisdom and colleagues (2007) pointed out that if technology accessibility were addressed during procurement the districts would spend less money, as retrofitting technology for accessibility is always more costly (Lazar et al., 2015).

## Evaluation of Inaccessible Technology in K–12

While much of the literature focuses on policy mandates and barriers to uptake, specific inaccessible technologies have also been examined in the corpus. The inaccessibility of

K–12 websites is the focus of much of the discussion, but computer-adapted testing and other instructional technologies are also addressed.

Six studies examined the accessibility of websites across K–12 from state departments of education, to school districts, to individual school building websites. An evaluation of the accessibility of all 50 state department of education websites and their corresponding special education department pages found that only 16% of state department of education websites and 42% of special education department pages were compliant with the Section 508 standards (Opitz, Savenye, & Rowland, 2003). A study of 567 district websites published the same year found that 74.3% had accessibility barriers (Bray, Flowers, & Gibson, 2003). A study of 534 district websites, published 6 years later, found that 86.14% were inaccessible (Krach & Jelenic, 2009). Krach and Jelenic (2009) also found that 83.1% of school building-level websites were inaccessible. Evaluations of elementary-school websites found that 57.4% of 244 sites had accessibility barriers (Bray, Flowers, Smith, & Algozzine, 2003) and that 91% of 147 sites had accessibility barriers (Wells & Barron, 2006). Finally, a study of 165 middle-school websites found that 58% had accessibility barriers (Bray et. al, 2007). These studies point to a consistent pattern of inaccessible websites across all levels of K–12 education.

Across all of the K–12 website accessibility evaluation studies, the most common accessibility barrier found was missing or insufficient image descriptions. Accessibility standards require that images have alternative text—a textual description of the image that provides blind people access to graphical information. The vast majority of the websites examined across the corpus had missing or insufficient alternative text for their images (Bray, Flowers, & Gibson, 2003; Bray, Flowers, Smith, et al. 2003, Bray et al, 2007; Opitz et al, 2003; Wells & Barron, 2006).

One study looked beyond websites and examined the accessibility of a computer-adapted test administered at a school for the blind. Findings suggested that 20.55% of 42 test questions were unanswerable by blind students due to accessibility barriers (Kamei-Hannan, 2008). The most common accessibility barriers found in the test included pictures without alternative text, Braille translation errors, and interface elements that required the use of a mouse. Other inaccessible technologies that were briefly mentioned in the corpus include Kindle devices, eBooks, electronic documents, learning management systems, Common Core State Standards assessments, Google Applications for Education, Google Chromebooks, and math software (Shaheen & Lazar, 2018; Hashey & Stahl, 2014; *Nightingale v. Seattle School District*, 2014; U.S. Department of Education & U.S. Department of Justice, 2010). Though these technologies were not examined in depth in the literature, the most common inaccessible features of these instructional technologies can be gleaned—a list that significantly overlaps with the barriers identified in websites and computer adapted tests. Common inaccessible features of these instructional technologies include missing alternative text for images, weak semantic structure (e.g., headings, button and form field labels), and interface elements that require the use of a mouse.

## Discussion

The findings from this literature review indicate that the discourse surrounding technology accessibility in K–12 has centered around four key themes. First, technology accessibility is a mandate, which is rooted in both federal and state policies. Second, dissatisfied with the state of the field, accessibility advocates have encouraged K–12 stakeholders to act by promoting technology accessibility. Third, there are barriers that K–12 stakeholders must overcome in order to implement technology accessibility. Finally, there has been a consistent pattern over the last fifteen years of using inaccessible technologies, particularly Web technologies, in K–12.

How can an understanding of the discourse and practice pertaining to K–12 technology accessibility shape future work in the field of instructional technology to ensure equitable access for all learners? To begin to make meaning of the findings from the literature review, this section draws connections between the findings and adjacent literature, as well as relevant current events. After examining each of the four themes, a discussion of weaknesses in the corpus is offered. This section begins with a discussion of technology accessibility as a mandate, specifically exploring why the ADA and the Rehabilitation Act of 1973 receive greater attention than IDEA in the literature.

IDEA is arguably the most prominent law in the United States pertaining to the education of disabled students in K–12 schools. Therefore, it may seem surprising that IDEA is not discussed more frequently and is somewhat dismissed in the technology accessibility literature. Though some scholars argued that IDEA does address technology accessibility (Krach & Jelenic, 2009), it has not been a vehicle that disabled people have employed when taking legal action against K–12 schools that use inaccessible technology; rather, the ADA and the Rehabilitation Act of 1973 have been the primary legal vehicles (Shaheen & Lazar, 2018; *Nightingale v. Seattle School District*, 2014).

An examination of two key aspects of the construct of technology accessibility helps to explain why advocates and scholars may have leveraged broader disability rights laws, as opposed to IDEA, when arguing for accessible technology. First, technology accessibility, like building accessibility, is a system-level, not an individual-level, concern, as it pertains to mainstream technology. That is to say, technology accessibility is best addressed at the time of procurement or development, rather than after a disabled person makes their presence known—an approach that is connected to the construct of universal design, which will be addressed in more detail later in the section. If a K–12 school waits until a disabled student enters the building or an individualized education program (IEP) meeting is called to worry about whether or not their technology or their school building is accessible, it is too late; the school and the student will be perpetually behind as retrofits and work-arounds are negotiated and implemented. Second, the accessibility of technology impacts all disabled stakeholders (i.e., parents, employees, community members), not just students. Since the ADA and the Rehabilitation Act of 1973 require that programs, services, and activities are accessible to disabled people, whether or not disabled people appear to be involved in district activities, these laws encourage districts to think broadly about accessibility for many disabled stakeholders from the beginning. Conversely, IDEA's purpose is to ensure individual disabled students receive a free and appropriate public education (FAPE) and that the educational experience is tailored to meet each student's unique needs. Thus, IDEA is focused on individual disabled students rather than on the broader needs of disabled people of all ages. The focus of the ADA and the Rehabilitation Act of 1973 on all disabled people and on addressing accessibility at inception is likely the reason that the U.S. Departments of Education and Justice (2010) referenced these two laws, rather than IDEA, when reminding educational entities of their responsibility to use accessible technology.

The focus on the ADA and the Rehabilitation Act of 1973 in the technology accessibility literature, however, does not mean that the IDEA has no relevance to the education of disabled students in the 21st century. Merely providing accessible technologies and buildings in accordance with the ADA and the Rehabilitation Act of 1973 is insufficient to ensure that disabled students receive a FAPE. Many disabled students will also need special education and related services in order to benefit from twenty-first-century education. For example, in an accessible twenty-first-century school, a blind student will still need AT (e.g., screen access software) as well as specifically designed instruction in how to use that AT in order to receive a FAPE. These services would be outlined in the blind student's IEP, as required by IDEA. The ADA and the Rehabilitation Act of 1973 provide general

access to the analog and digital school environments, and the IDEA ensures that each disabled student's unique needs are met and that each receives a FAPE.

In addition to discussion of technology accessibility as a mandate, work to promote technology accessibility and encourage K–12 stakeholders to act also received attention in the literature. All of the state-level work discussed in the corpus occurred in the early 2000s, following the enactment of the original Section 508 statute and regulations (Lazar et al., 2015). It has been argued that the original Section 508 regulations were the impetus for the state-level work on technology accessibility at the turn of the century (Golden & Buck, 2003). By the time the executive branch of the federal government, prompted by complaints from disability advocates, issued policy guidance to promote technology accessibility and encourage K–12 to act, the Section 508 regulations were a decade old, and notably out-of-date due to technological development. In January 2017, the long-awaited refresh to the Section 508 regulations was released and the regulations went into effect that March. The updated Section 508 regulations and the recent influx of OCR complaints may engender another wave of state-level work to promote technology accessibility and encourage K–12 stakeholders to act.

The encouragement for K–12 stakeholders to work on technology accessibility, which came from state and federal government actors as well as disability advocates, was motivated, in part, by dissatisfaction with the state of the field. The limited work occurring in K–12 around technology accessibility could have been due to the barriers discussed in the literature. One of the largest barriers addressed was a lack of awareness and a lack of basic knowledge about technology accessibility. This problem, though significant, is not unique to K–12. Lack of awareness about technology accessibility has also been well documented in higher education (Asuncion et al., 2010; Lazar et al., 2015). In order for technology accessibility to be implemented, stakeholders must certainly be aware of accessibility, but they must also have deeper knowledge of accessibility (e.g., how to determine if a technology is accessible, how to remediate barriers). The literature indicated that the K–12 stakeholders who had basic awareness about technology accessibility often lacked the requisite deeper knowledge to carry out accessibility work (Hendricks et al., 2003; Noble, 2005; Wisdom et. al, 2007).

Given the knowledge barrier, as well as the other impediments addressed in the literature, it is predictable that inaccessible websites are common in K–12, and it also follows that inaccessible websites are common in other industries, including higher education, state and local government, federal government, and the private sector (Asuncion et al., 2010; Fichten et al., 2009; Lazar et al., 2015; Wentz et al., 2014). These inaccessible websites, and other technologies, have resulted in legal action against higher education institutions, local government, and for-profit businesses (Lazar et al., 2015). To avoid legal action, organizations must integrate website accessibility into their Web management strategy and quality assurance monitoring because as a website evolves (e.g., content is added, the design is modified) so does its accessibility.

Though there has been limited work on technology accessibility in K–12, in recent years, the construct of Universal Design for Learning (UDL) has received increased attention in the field. The constructs of UDL and technology accessibility share the common theoretical heritage of Universal Design (Mace, 1985). However, the purpose and the particulars of each construct differ. In general, the purpose of technology accessibility is to ensure that disabled people can use technology and the purpose of UDL is to create flexible learning environments that work for everyone by providing multiple means of engagement, representation, and action and expression (Rose, Meyer, & Hitchcock, 2005). Technology accessibility focuses on technology, but does not address disabled people's access to learning. Conversely, UDL focuses on learning, but does not directly address disabled people's access to technology. A technology that meets all of the technology accessibility standards might

not adequately address the learning needs of disabled students, and a UDL-aligned lesson that uses an inaccessible technology would pose barriers to many disabled students. In a twenty-first-century learning environment, for disabled students to participate fully they need access to both technology and learning. Therefore, we assert that UDL and technology accessibility are complimentary constructs that must be used in concert to ensure disabled students can fully participate.

Finally, the available literature offers some insight into the technology accessibility discourse in K–12, but it leaves several aspects of discourse and practice unaddressed. Looking across the sample, five weaknesses are evident. First, the sample as a whole is fairly dated, particularly given the pace of technological development. Second, there is a dearth of current empirical research on the topic. Third, the existing empirical research is dominated by quantitative studies using automated tools to evaluate website accessibility; these articles, though helpful, only tell one piece of the K–12 technology accessibility story, as technology accessibility is an issue that extends beyond Web-based technologies. Fourth, aside from the one qualitative study examining barriers to the adoption of technology accessibility in K–12 (i.e., Wisdom et. al, 2007), there is no empirical research about what, why, and how K–12 stakeholders are or are not engaging with technology accessibility. Finally, there is no literature addressing the impact of accessible or inaccessible technology on the performance or lived experience of disabled K–12 students.

## Recommendations

Access to education is a civil right in the United States. Today, accessing education increasingly requires the use of technology. However, not all technologies are accessible to all people. Inaccessible technologies erect barriers and exclude disabled people from participating—thereby discriminating against them solely on the basis of their disability, discrimination that is prohibited under U.S. law. In K–12 schools, inaccessible technologies, particularly Web technologies, are commonplace. In the last few years, the presence of inaccessible technologies has prompted advocates to file OCR complaints and lawsuits against K–12 institutions. Therefore, many K–12 stakeholders are looking for guidance about how to proceed.

Findings from the literature review indicate three key areas where K–12 stakeholders could focus future effort to ensure that disabled people have equal access to technology in K–12. First, K–12 stakeholders could work to increase knowledge about technology accessibility among educators, administrators, and technologists. Second, K–12 stakeholders could incorporate accessibility into the procurement process for all technologies (e.g., Web-based technology, software, and digital instructional materials). Finally, researchers and K–12 stakeholders could work together to produce additional research to bolster the knowledgebase about technology accessibility in K–12.

Limited knowledge and awareness about technology accessibility was identified as a key impediment to technology accessibility adoption and implementation in K–12. The technology accessibility knowledge gap could be addressed in higher education, for preservice educators, and with professional development for in-service educators. In higher education, teacher and administrator preparation programs could incorporate material on technology accessibility into coursework in instructional technology, instructional design, and education law. For those already employed in K–12, professional development could be implemented for administrators, technology staff, and classroom teachers. Professional development for administrators and technology staff might focus on the legal requirements, accessibility evaluation, and accessible Web development. Professional development for classroom teachers could focus on making electronic documents accessible, writing alternative text for images, and the importance of evaluating instructional technologies for accessibility prior to incorporating them into instruction.

With additional knowledge, K–12 stakeholders would be in a good position to begin working on technology procurement—incorporating technology accessibility into technology acquisition the same way that ADA requirements are incorporated into the construction of a new school building. To incorporate accessibility into technology procurement processes there are four important steps K–12 stakeholders could take. First, districts could incorporate technology accessibility requirements into their requests for proposals when initiating a procurement cycle. Second, districts could review Voluntary Product Accessibility Templates (VPATs) for all of the technology that is being considered for purchase. Third, once the field of vendors and products has been narrowed to the final candidates, districts could conduct their own manual accessibility evaluations, if they have the requisite knowledge to do so, or require vendors to obtain independent third-party accessibility evaluations to ensure the technologies are accessible prior to making a final purchasing decision. Finally, districts could add terms to their vendor contracts that (a) hold the vendor liable for maintaining an accessible product and (b) provide the district with recourse if the vendor's product turns out to be inaccessible or becomes inaccessible in the future (see Lazar et al. 2015).

In addition to increasing knowledge about technology accessibility and incorporating accessibility into technology procurement processes, K–12 stakeholders could collaborate to produce additional research. As discussed previously, there are weaknesses in the literature that need to be bolstered in order to develop a full understanding of K–12 technology accessibility discourse and practice. To do so, researchers and K–12 stakeholders could facilitate empirical research focusing on three key topics, which have not yet been adequately addressed. First, future empirical research could examine what technology accessibility work K–12 schools are doing and what factors encourage and accelerate the work and what factors impede the work. Second, future research could move beyond automated evaluations of websites and investigate the accessibility of instructional technologies, which are both Web-based and non-Web-based, that are commonly used in K–12 classrooms today. Finally, future research could investigate the impact of both accessible and inaccessible K–12 technology on the performance and lived experience of disabled students, educators, and parents. Bolstering the knowledgebase about K–12 technology accessibility will provide K–12 stakeholders and technology accessibility advocates with the knowledge and resources needed to continue to ensure disabled people have equal access to K–12 technology.

Received 9 September 2018
Revised 26 November 2018
Accepted 10 December 2018

## Author Notes

Natalie L. Shaheen is a doctoral candidate in instructional technology at Towson University. Natalie's research focuses on equity and access for disabled people in technology-enhanced learning environments. Please address correspondence regarding this article to Natalie L. Shaheen, College of Education, Department of Educational Technology and Literacy, Towson University, 8000 York Road, Towson, MD 21252-0001, USA. E-mail: nlshaheen@gmail.com

Sarah Lohnes Watulak, Ed.D, is Director of Digital Pedagogy and Media in the Office of Digital Learning and Inquiry at Middlebury College (VT), where she seeks to create digital learning opportunities and environments that support learner agency and equity. Dr. Lohnes Watulak's research interests focus on inclusive design, critical digital literacies, and connected learning.

## References


Asuncion, J. V., Fichten, C. S., Ferraro, V., Chwojka, C., Barile, M., Nguyen, M. N., & Wolforth, J. (2010). Multiple perspectives on the accessibility of e-learning in Canadian colleges and universities. *Assistive Technology*, *22*(4), 187–199. doi:10.1080/10400430903519944

Bray, M., Pugalee, D., Flowers, C. P., & Algozzine, B. (2007). Accessibility of middle schools' Web sites for students with disabilities. *The Clearing House*, *80*(4), 169–178. doi:10.3200/TCHS.80.4.169-178

Bray, M., Flowers, C. P., & Gibson, P. (2003). Accessibility of school districts' web sites: A descriptive study. *Information Technology in Childhood Education Annual*, *1*, 209–221. Retrieved from https://www.learntechlib.org/primary/j/ITCE/

Bray, M., Flowers, C. P., Smith, S., & Algozzine, R. F. (2003). Accessibility of elementary schools' web sites for students with disabilities. *Education*, *123*(4), 815–830. Retrieved from https://www.projectinnovation.com/education.html

Brown, L. (2011). *Identity first language*. Retrieved from http://autisticadvocacy.org/about-asan/identity-first-language/

Brueggemann, B. J. (2013). Disability studies/disability culture. In M. L. Wehmeyer (Ed.), *Oxford handbook of positive psychology and disability* (pp. 279–299). New York, NY: New York: Oxford University Press.

Davis, L. J. (Ed.). (2013). *The disability studies reader* (4th ed.). New York, NY: Routledge.

Dunn, D. S., & Andrews, E. E. (2015). Person-first and identity-first language: Developing psychologists' cultural competence using disability language. *American Psychologist*, *70*(3), 255–264. doi:10.1037/a0038636

Fichten, C., Ferraro, V., Asuncion, J., Chwojka, C., Barile, M., Nguyen, M., … Wolforth, J. (2009). Disabilities and e-learning problems and solutions: an exploratory study. *Educational Technology and Society*, *12*(4), 241–256. Retrieved from https://www.j-ets.net/ETS/index.html

Foley, A., & Ferri, B. A. (2012). Technology for people, not disabilities: Ensuring access and inclusion. *Journal of Research in Special Educational Needs*, *12*(4), 192–200. doi:10.1111/j.1471-3802.2011.01230.x

Gee, J. P., & Hayes, E. (2010). *Women and gaming: the Sims and 21st century learning*. New York: Palgrave Macmillan, *2010*.

Golden, D. C., & Buck, D. V. (2003). State IT accessibility policy: The landscape of today. *Information Technology and Disabilities*, *9*(1), 1–11. Retrieved from http://itd.athenpro.org

Hashey, A. I., & Stahl, S. (2014). Making online learning accessible for students with disabilities. *Teaching Exceptional Children*, *46*(5), 70–78. doi:10.1177/0040059914528329

Hendricks, P., Wahl, L., Stull, J., & Duffield, J. (2003). From policy to practice: Achieving equitable access to educational technology. *Information Technology and Disabilities*, *9*(1), 1–23. Retrieved from http://itd.athenpro.org

Kamei-Hannan, C. (2008). Examining the accessibility of a computerized adapted test using assistive technology. *Journal of Visual Impairment & Blindness*, *102*(5), 261–271. Retrieved from http://www.afb.org/afbpress/jvib.aspx

Kaplan, S., Weiss, S., & Allen, M. (2006). Promising Practices of Accessible Information Technology in K-12 Educational Settings. In C. Crawford, R. Carlsen, K. McFerrin, J. Price, R. Weber & D. Willis (Eds.), *Proceedings of society for information technology & teacher education international conference 2006* (pp. 2284–2289). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Keierleber, M. (2018). A civil rights activist filed thousands of disability complaints. Now the education department is trying to shut her down. *The 74*. Retrieved from https://www.the74million.org/article/a-civil-rights-activist-filed-thousands-of-disability-complaints-now-the-education-department-is-trying-to-shut-her-down/

Krach, S., & Jelenic, M. (2009). The other technological divide: K-12 web accessibility. *Journal of Special Education Technology*, *24*(2), 31–37. Retrieved from http://jst.sagepub.com/content/24/2/31.short doi:10.1177/016264340902400203

Lazar, J., Goldstein, D. F., & Taylor, A. (2015). *Ensuring digital accessibility through process and policy*. Waltham, MA: Morgan Kaufmann.

Mace, R. (1985). Universal design: Barrier-free environments for everyone. *Designers West*, *33*(1), 147–152.

Mehta, S., Good, J., Sands, P., Yadav, A., Gretter, S., & Levenhagen-Seeley, J. (2018). Impact of after-school learning programs on high school girls' confidence and interest in computing. In E. Langran & J. Borup (Eds.), *Proceedings of society for information technology & teacher education international conference* (pp. 372–378). Washington, D.C., United States: Association for the advancement of computing in education (AACE). Retrieved from https://www.learntechlib.org/primary/p/182551/

National Federation of the Blind (NFB). (1993). Resolution 93–01. Retrieved from http://www.nfb.org/images/nfb/Publications/bm/bm09/bm0903/bm090308.htm

Nightingale v. Seattle School District, No. C14-1286 RAJ W.D. Wash. August 20, (2014).

Noble, S. (2005). The Kentucky accessible information technology in schools project. *Information Technology and Disabilities*, *11*(1), 1. Retrieved from http://itd.athenpro.org

Opitz, C., Savenye, W., & Rowland, C. (2003). Accessibility of state department of education home pages and special education pages. *Journal of Special Education Technology*, *18*(1), 17–28. Retrieved from https://journals.sagepub.com/home/jst doi:10.1177/016264340301800102

Peterson, K. (2005). Systems change regarding accessible information technology in the K-12 educational environment. *Information Technology and Disabilities*, *11*(1), 1. Retrieved from http://itd.athenpro.org/volume11/number1/peterson.html

Rose, D. H., Meyer, A. D., & Hitchcock, C. (Eds) (2005). *The universally designed classroom: Accessible curriculum and digital technologies*. Cambridge, MA: Harvard Education Press.

Shaheen, N. L., & Lazar, J. (2018). K-12 technology accessibility: The message from state governments. *The Journal of Special Education Technology*, *33*(2), 83–97. doi:10.1177%2F0162643417734557

U.S. Access Board. (2017). About the ICT refresh. Retrieved from https://www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-ict-refresh

U.S. Department of Education, Office for Civil Rights. (2011). Frequently asked questions about the June 29, 2010, Dear Colleague Letter. Retrieved from the Department of Education website http://www2.ed.gov/about/offices/list/ocr/docs/dcl-ebook-faq-201105.pdf

U.S. Department of Justice, Civil Rights Division & U.S. Department of Education, Office for Civil Rights. (2010). Joint Dear Colleague Letter: Electronic book readers by T. E. Perez and R. Ali. Retrieved from the Department of Education website http://www2.ed.gov/about/offices/list/ocr/letters/colleague-20100629.html

VandenBos, G. R. (Ed). (2010). *Publication manual of the American psychological association* (6th ed.). Washington, DC: American Psychological Association.

Vanderheiden, G. (1988). *Considerations in the design of computers to increase their accessibility by persons with disabilities*. Retrieved from https://trace.umd.edu/publications/considerations-design-computers-increase-their-accessibility-persons-disabilities

Vanderheiden, G. C. (1990). Thirty-something million: Should they be exceptions? *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *32*(4), 383–396. doi:10.1177/001872089003200402

Vossoughi, S., Hooper, P. K., & Escudé, M. (2016). Making through the lens of culture and power: Toward transformative visions for educational equity. *Harvard Educational Review*, *86*(2), 206–232. doi:10.17763/0017-8055.86.2.206

Warschauer, M. (2002). Reconceptualizing the digital divide. *First Monday*, *7*, 7. Retrieved from http://firstmonday.org/article/view/967/888/

Wells, J. A., & Barron, A. E. (2006). School web sites: Are they accessible to all? *Journal of Special Education Technology*, *21*(3), 23–30. doi:10.1177/016264340602100303

Wentz, B., Lazar, J., Stein, M., Gbenro, O., Holandez, E., & Ramsey, A. (2014). Danger, danger! Evaluating the accessibility of web-based emergency alert sign-ups in the Northeastern United States. *Government Information Quarterly*, *31*(3), 488–497. doi:10.1016/j.giq.2014.02.010

Wisdom, J. P., White, N., Goldsmith, K., Bielavitz, S., Rees, A., & Davis, C. (2007). Systems limitations hamper integration of accessible information technology in northwest U.S. K-12 schools. *Educational Technology & Society*, *10*(3), 222–232. Retrieved from https://www.j-ets.net/ETS/index.html

World Wide Web Consortium. 2013. (\\chenas03.cadmus.com\SmartEdit\WatchFolder\XML_Signal_to_CCE_High_Speed_WF\ESA\IN\INPROCESS\40). *Guidance on applying WCAG 2.0 to non-web information and communications technologies.* Retrieved from https://www.w3.org/TR/wcag2ict/